

## Preliminary Classification:

Proposed Class:

Subclass:

NOTE: "All applicants are requested to include a preliminary classification on newly filed patent applications. The preliminary classification, preferably class and subclass designations, should be identified in the upper right-hand corner of the letter of transmittal accompanying the application papers, for example 'Proposed Class 2, subclass 129.' " M.P.E.P., § 601, 7th ed.

**TRANSMITTAL LETTER  
TO THE UNITED STATES ELECTED OFFICE (EO/US)  
(ENTRY INTO U.S. NATIONAL PHASE UNDER CHAPTER II)**

|   |   |  |
|---|---|--|
| INTERNATIONAL APPLICATION NO.<br>PCT/IB99/02076 | INTERNATIONAL FILING DATE<br>13 December 1999 | PRIORITY DATE CLAIMED<br>14 December 1998 & 17 November 1999 |
|---|---|--|

TITLE OF INVENTION

LOCATING SYSTEM FOR MOBILE STATIONS

APPLICANT(S)

Jens STAACK, Kengatharan SIVALINGAM, Timo TUHKALAINEN

**Box PCT****Assistant Commissioner for Patents****Washington D.C. 20231****ATTENTION: EO/US****CERTIFICATION UNDER 37 C.F.R. §§ 1.8(a) and 1.10\***

*(When using Express Mail, the Express Mail label number is mandatory;  
Express Mail certification is optional.)*

I hereby certify that, on the date shown below, this correspondence is being:

**MAILING**

☒ deposited with the United States Postal Service in an envelope addressed to the Assistant Commissioner for Patents, Washington, D.C. 20231

**37 C.F.R. § 1.8(a)****37 C.F.R. § 1.10 \***☐ with sufficient postage as first class mail.☒ as "Express Mail Post Office to Addressee"

Mailing Label No. EL627425795US (mandatory)

**TRANSMISSION**☐ facsimile transmitted to the Patent and Trademark Office, (703)

Signature

June Adams

(type or print name of person certifying)

Date: 13 June 2001

\* Only the date of filing (§ 1.6) will be the date used in a patent term adjustment calculation, although the date on any certificate of mailing or transmission under § 1.8 continues to be taken into account in determining timeliness. See § 1.703(f). Consider "Express Mail Post Office to Addressee" (§ 1.10) or facsimile transmission (§ 1.6(d)) for the reply to be accorded the earliest possible filing date for patent term adjustment calculations.

**NOTE:** To avoid abandonment of the application, the applicant shall furnish to the USPTO, not later than 20 months from the priority date: (1) a copy of the international application, unless it has been previously communicated by the International Bureau or unless it was originally filed in the USPTO; and (2) the basic national fee (see 37 C.F.R. § 1.492(a)). The 30-month time limit may not be extended. 37 C.F.R. § 1.495.

**WARNING:** Where the items are those which can be submitted to complete the entry of the international application into the national phase are subsequent to 30 months from the priority date the application is still considered to be in the international state and if mailing procedures are utilized to obtain a date the express mail procedure of 37 C.F.R. § 1.10 must be used (since international application papers are not covered by an ordinary certificate of mailing—See 37 C.F.R. § 1.8.

**NOTE:** Documents and fees must be clearly identified as a submission to enter the national state under 35 U.S.C. § 371 otherwise the submission will be considered as being made under 35 U.S.C. § 111. 37 C.F.R. § 1.494(f).

- I. Applicant herewith submits to the United States Elected Office (EO/US) the following items under 35 U.S.C. § 371:
- a. ☒ This express request to immediately begin national examination procedures (35 U.S.C. § 371(f)).
  - b. ☒ The U.S. National Fee (35 U.S.C. § 371(c)(1)) and other fees (37 C.F.R. § 1.492) as indicated below:

## 2. Fees

JCD3 Rec'd PCT/PTC

13 JUN 2001

| CLAIMS<br>FEE            | (1) FOR   | (2) NUMBER<br>FILED | (3) NUMBER<br>EXTRA | (4) RATE | (5) CALCULA-<br>TIONS |
|--------------------------|---|---------------------|---------------------|----------|-----------------------|
| <input type="checkbox"/> | TOTAL<br>CLAIMS   | 23                  | -20=                | 3        | × \$18.00= \$ 54.00   |
|                          | INDEPENDENT<br>CLAIMS   | 5                   | 5 -3=               | 2        | × \$80.00= 160.00     |
|                          | MULTIPLE DEPENDENT CLAIM(S) (if applicable) + \$270.00  |                     |                     |          |                       |
| BASIC FEE**              | <input type="checkbox"/> U.S. PTO WAS INTERNATIONAL PRELIMINARY EXAMINATION<br>AUTHORITY<br>Where an international preliminary examination fee as set forth<br>in § 1.482 has been paid on the international application to the<br>U.S. PTO:<br><input type="checkbox"/> and the international preliminary examination report<br>states that the criteria of novelty, inventive step (non-<br>obviousness) and industrial activity, as defined in PCT<br>Article 33(1) to (4) have been satisfied for all the<br>claims presented in the application entering the<br>national stage (37 C.F.R. § 1.492(a)(4)) ..... \$100.00<br><input type="checkbox"/> and the above requirements are not met (37 C.F.R.<br>§ 1.492(a)(1)) ..... \$690.00 |                     |                     |          |                       |
|                          | <input checked="" type="checkbox"/> U.S. PTO WAS NOT INTERNATIONAL PRELIMINARY<br>EXAMINATION AUTHORITY<br>Where no international preliminary examination fee as set forth<br>in § 1.482 has been paid to the U.S. PTO, and payment of an<br>international search fee as set forth in § 1.445(a)(2) to the U.S.<br>PTO:<br><input type="checkbox"/> has been paid (37 C.F.R. § 1.492(a)(2)) ..... \$710.00<br><input type="checkbox"/> has not been paid (37 C.F.R. § 1.492(a)(3)) .... \$1000.00<br><input checked="" type="checkbox"/> where a search report on the international application<br>has been prepared by the European Patent Office or<br>the Japanese Patent Office (37 C.F.R.<br>§ 1.492(a)(5) ) ..... \$860.00            |                     |                     |          |                       |
|                          | Total of above Calculations   |                     |                     |          | = 1,074.00            |
| SMALL<br>ENTITY          | Reduction by 1/2 for filing by small entity, if applicable. Assertion<br>must be made. (note 37 C.F.R. § 1.27)  |                     |                     |          |                       |
|                          | Subtotal  |                     |                     |          | -                     |
|                          | Total National Fee  |                     |                     |          | \$ 1,074.00           |
|                          | Fee for recording the enclosed assignment document \$40.00 (37<br>C.F.R. § 1.21(h)). (See item 13 below). See attached "ASSIGNMENT<br>COVER SHEET".   |                     |                     |          |                       |
| TOTAL                    | Total Fees enclosed   |                     |                     |          | \$ 1,074.00           |

\*See attached Preliminary Amendment Reducing the Number of Claims.

- ☒ Attached is a ☒ check ☐ money order in the amount of \$ 1,074.00
- ☐ Authorization is hereby made to charge the amount of \$ \_\_\_\_\_
- ☒ to Deposit Account No. 16-1350
- ☐ to Credit card as shown on the attached credit card information authorization form PTO-2038.

**WARNING:** Credit card information should not be included on this form as it may become public.

- ☒ Charge any additional fees required by this paper or credit any overpayment in the manner authorized above.

A duplicate of this paper is attached.

**\*WARNING:** "To avoid abandonment of the application the applicant shall furnish to the United States Patent and Trademark Office not later than the expiration of 30 months from the priority date: \* \* \* (2) the basic national fee (see § 1.492(a)). The 30-month time limit may not be extended." 37 C.F.R. § 1.495(b).

**WARNING:** If the translation of the international application and/or the oath or declaration have not been submitted by the applicant within thirty (30) months from the priority date, such requirements may be met within a time period set by the Office. 37 C.F.R. § 1.495(b)(2). The payment of the surcharge set forth in § 1.492(e) is required as a condition for accepting the oath or declaration later than thirty (30) months after the priority date. The payment of the processing fee set forth in § 1.492(f) is required for acceptance of an English translation later than thirty (30) months after the priority date. Failure to comply with these requirements will result in abandonment of the application. The provisions of § 1.136 apply to the period which is set. Notice of Jan. 3, 1993, 1147 O.G. 29 to 40.

- ☐ Assertion of Small Entity Status
- ☐ Applicant hereby asserts status as a small entity under 37 C.F.R. § 1.27.

**NOTE:** 37 C.F.R. § 1.27(c) deals with the assertion of small entity status, whether by a written specific declaration thereof or by payment as a small entity of the basic filing fee or the fee for the entry into the national phase as states:

"(c) Assertion of small entity status. Any party (person, small business concern or nonprofit organization) should make a determination, pursuant to paragraph (f) of this section, of entitlement to be accorded small entity status based on the definitions set forth in paragraph (a) of this section, and must, in order to establish small entity status for the purpose of paying small entity fees, actually make an assertion of entitlement to small entity status, in the manner set forth in paragraphs (c)(1) or (c)(3) of this section, in the application or patent in which such small entity fees are to be paid.

(1) Assertion by writing. Small entity status may be established by a written assertion of entitlement to small entity status. A written assertion must:

- (i) Be clearly identifiable;
- (ii) Be signed (see paragraph (c)(2) of this section); and
- (iii) Convey the concept of entitlement to small entity status, such as by stating that applicant is a small entity, or that small entity status is entitled to be asserted for the application or patent. While no specific words or wording are required to assert small entity status, the intent to assert small entity status must be clearly indicated in order to comply with the assertion requirement.

(2) Parties who can sign and file the written assertion. The written assertion can be signed by:

- (i) One of the parties identified in §§ 1.33(b) (e.g., an attorney or agent registered with the Office), §§ 3.73(b) of this chapter notwithstanding, who can also file the written assertion;
- (ii) At least one of the individuals identified as an inventor (even though a §§ 1.63 executed oath or declaration has not been submitted), notwithstanding §§ 1.33(b)(4), who can also file the written assertion pursuant to the exception under §§ 1.33(b) of this part; or
- (iii) An assignee of an undivided part interest, notwithstanding §§ 1.33(b)(3) and 3.73(b) of this chapter, but the partial assignee cannot file the assertion without resort to a party identified under §§ 1.33(b) of this part.

(Transmittal Letter to the United States Elected Office (EO-US) [13-18]—page 4 of 9)

(3) Assertion by payment of the small entity basic filing or basic national fee. The payment, by any party, of the exact amount of one of the small entity basic filing fees set forth in §§ 1.16(a), (f), (g), (h), or (i), or one of the small entity basic national fees set forth in §§ 1.492(a)(1), (a)(2), (a)(3), (a)(4), or (a)(5), will be treated as a written assertion of entitlement to small entity status even if the type of basic filing or basic national fee is inadvertently selected in error.

(i) If the Office accords small entity status based on payment of a small entity basic filing or basic national fee under paragraph (c)(3) of this section that is not applicable to that application, any balance of the small entity fee that is applicable to that application will be due along with the appropriate surcharge set forth in §§ 1.16(e), or §§ 1.16(f).

(ii) The payment of any small entity fee other than those set forth in paragraph (c)(3) of this section (whether in the exact fee amount or not) will not be treated as a written assertion of entitlement to small entity status and will not be sufficient to establish small entity status in an application or a patent."

3. ☒ A copy of the International application as filed (35 U.S.C. § 371(c)(2)):

NOTE: Section 1.495 (b) was amended to require that the basic national fee and a copy of the international application must be filed with the Office by 30 months from the priority date to avoid abandonment. "The International Bureau normally provides the copy of the international application to the Office in accordance with PCT Article 20. At the same time, the International Bureau notifies applicant of the communication to the Office. In accordance with PCT Rule 47.1, that notice shall be accepted by all designated offices as conclusive evidence that the communication has duly taken place. Thus, if the applicant desires to enter the national stage, the applicant normally need only check to be sure the notice from the International Bureau has been received and then pay the basic national fee by 30 months from the priority date." Notice of Jan. 7, 1993, 1147 O.G. 29 to 40, at 35-36. See item 14c below.

- a. ☐ is transmitted herewith.
- b. ☐ is not required, as the application was filed with the United States Receiving Office.
- c. ☒ has been transmitted
  - i. ☒ by the International Bureau.

Date of mailing of the application (from form PCT/1B/308):

6/22/00

- ii. ☐ by applicant on \_\_\_\_\_. (Date)

4. ☐ A translation of the International application into the English language (35 U.S.C. § 371(c)(2)):

- a. ☐ is transmitted herewith.
- b. ☐ is not required as the application was filed in English.
- c. ☐ was previously transmitted by applicant on \_\_\_\_\_. (Date)
- d. ☐ will follow.

5. ☒ Amendments to the claims of the International application under PCT Article 19 (35 U.S.C. § 371(c)(3)):

NOTE: *The Notice of January 7, 1993 points out that 37 C.F.R. § 1.495(a) was amended to clarify the existing and continuing practice that PCT Article 19 amendments must be submitted by 30 months from the priority date and this deadline may not be extended. The Notice further advises that: "The failure to do so will not result in loss of the subject matter of the PCT Article 19 amendments. Applicant may submit that subject matter in a preliminary amendment filed under section 1.121. In many cases, filing an amendment under section 1.121 is preferable since grammatical or idiomatic errors may be corrected." 1147 O.G. 29-40, at 36.*

- a. ☐ are transmitted herewith.
- b. ☐ have been transmitted
  - i. ☐ by the International Bureau.  
Date of mailing of the amendment (from form PCT/1B/308):  
\_\_\_\_\_
  - ii. ☐ by applicant on \_\_\_\_\_ (Date)
- c. ☒ have not been transmitted as
  - i. ☒ applicant chose not to make amendments under PCT Article 19.  
Date of mailing of Search Report (from form PCT/ISA/210):  
4/17/00
  - ii. ☐ the time limit for the submission of amendments has not yet expired. The amendments or a statement that amendments have not been made will be transmitted before the expiration of the time limit under PCT Rule 46.1.

6. ☒ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. § 371(c)(3)):
- a. ☐ is transmitted herewith.
  - b. ☐ is not required as the amendments were made in the English language.
  - c. ☒ has not been transmitted for reasons indicated at point 5(c) above.
7. ☒ A copy of the international examination report (PCT/IPEA/409)  
☒ is transmitted herewith.  
☐ is not required as the application was filed with the United States Receiving Office.
8. ☒ Annex(es) to the international preliminary examination report
- a. ☒ is/are transmitted herewith.
  - b. ☐ is/are not required as the application was filed with the United States Receiving Office.
9. ☒ A translation of the annexes to the international preliminary examination report
- a. ☐ is transmitted herewith.
  - b. ☒ is not required as the annexes are in the English language.

10. ☒ An oath or declaration of the inventor (35 U.S.C. § 371(c)(4)) complying with 35 U.S.C. § 115
- a. ☐ was previously submitted by applicant on \_\_\_\_\_. (Date)
  - b. ☐ is submitted herewith, and such oath or declaration
    - i. ☐ is attached to the application.
    - ii. ☐ identifies the application and any amendments under PCT Article 19 that were transmitted as stated in points 3(b) or 3(c) and 5(b); and states that they were reviewed by the inventor as required by 37 C.F.R. § 1.70.
  - c. ☒ will follow.

II. Other document(s) or information included:

11. ☒ An International Search Report (PCT/ISA/210) or Declaration under PCT Article 17(2)(a):
- a. ☒ is transmitted herewith.
  - b. ☐ has been transmitted by the International Bureau.  
Date of mailing (from form PCT/IB/308): \_\_\_\_\_
  - c. ☐ is not required, as the application was searched by the United States International Searching Authority.
  - d. ☐ will be transmitted promptly upon request.
  - e. ☐ has been submitted by applicant on \_\_\_\_\_. (Date)
12. ☒ An Information Disclosure Statement under 37 C.F.R. §§ 1.97 and 1.98:
- a. ☒ is transmitted herewith.

Also transmitted herewith is/are:

- ☒ Form PTO-1449 (PTO/SB/08A and 08B).
  - ☒ Copies of citations listed.
  - b. ☐ will be transmitted within THREE MONTHS of the date of submission of requirements under 35 U.S.C. § 371(c).
  - c. ☐ was previously submitted by applicant on \_\_\_\_\_. (Date)
13. ☐ An assignment document is transmitted herewith for recording.

A separate ☐ "COVER SHEET FOR ASSIGNMENT (DOCUMENT) ACCOMPANYING NEW PATENT APPLICATION" or ☐ FORM PTO 1595 is also attached.

14. ☒ Additional documents:

- a. ☒ Copy of request (PCT/RO/101)
- b. ☒ International Publication No. WO 00/36430
- i. ☒ Specification, claims and drawing
- ii. ☐ Front page only
- c. ☒ Preliminary amendment (37 C.F.R. § 1.121)
- d. ☒ Other  
Demand, Written Opinion, PCT/IPEA/416, PCT/IB/308

15. ☒ The above checked items are being transmitted

- a. ☒ before 30 months from any claimed priority date.
- b. ☐ after 30 months.

16. ☐ Certain requirements under 35 U.S.C. § 371 were previously submitted by the applicant on \_\_\_\_\_, namely:

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**AUTHORIZATION TO CHARGE ADDITIONAL FEES**

**WARNING:** Accurately count claims, especially multiple dependant claims, to avoid unexpected high charges if extra claims are authorized.

**NOTE:** "A written request may be submitted in an application that is an authorization to treat any concurrent or future reply, requiring a petition for an extension of time under this paragraph for its timely submission, as incorporating a petition for extension of time for the appropriate length of time. An authorization to charge all required fees, fees under § 1.17, or all required extension of time fees will be treated as a constructive petition for an extension of time in any concurrent or future reply requiring a petition for an extension of time under this paragraph for its timely submission. Submission of the fee set forth in § 1.17(a) will also be treated as a constructive petition for an extension of time in any concurrent reply requiring a petition for an extension of time under this paragraph for its timely submission." 37 C.F.R. § 1.136(a)(3).

**NOTE:** "Amounts of twenty-five dollars or less will not be returned unless specifically requested within a reasonable time, nor will the payer be notified of such amounts; amounts over twenty-five dollars may be returned by check or, if requested, by credit to a deposit account." 37 C.F.R. § 1.26(a).

☒ Please charge, in the manner authorized above, the following additional fees that may be required by this paper and during the entire pendency of this application:

- ☒ 37 C.F.R. § 1.492(a)(1), (2), (3), and (4) (filing fees)

**WARNING:** Because failure to pay the national fee within 30 months without extension (37 C.F.R. § 1.495(b)(2)) results in abandonment of the application, it would be best to always check the above box.



- ☒ 37 C.F.R. § 1.492(b), (c) and (d) (presentation of extra claims)

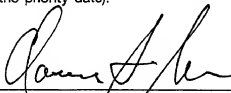
NOTE: Because additional fees for excess or multiple dependent claims not paid on filing or on later presentation must only be paid or these claims cancelled by amendment prior to the expiration of the time period set for response by the PTO in any notice of fee deficiency (37 C.F.R. § 1.492(d)), it might be best not to authorize the PTO to charge additional claim fees, except possible when dealing with amendments after final action.

- ☒ 37 C.F.R. § 1.17 (application processing fees)
- ☒ 37 C.F.R. § 1.17(a)(1)-(5) (extension fees pursuant to § 1.136(a).
- ☐ 37 C.F.R. § 1.18 (issue fee at or before mailing of Notice of Allowance, pursuant to 37 C.F.R. § 1.311(b))

NOTE: Where an authorization to charge the issue fee to a deposit account has been filed before the mailing of a Notice of Allowance, the issue fee will be automatically charged to the deposit account at the time of mailing the notice of allowance. 37 C.F.R. § 1.311(b).

NOTE: 37 C.F.R. § 1.28(b) requires "Notification of any change in loss of entitlement to small entity status must be filed in the application . . . prior to paying, or at the time of paying . . . issue fee." From the wording of 37 C.F.R. § 1.28(b); (e) notification of change of status must be made even if the fee is paid as "other than a small entity" and (b) no notification is required if the change is to another small entity.

- ☒ 37 C.F.R. § 1.492(e) and (f) (surcharge fees for filing the declaration and/or filing an English translation of an International Application later than 30 months after the priority date).



SIGNATURE OF PRACTITIONER

Clarence A. Green

(type or print name of practitioner)

PERMAN & GREEN, LLP

P.O. Address

425 Post Road, Fairfield, CT 06430 USA

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Tel. No.: 203 ) 259-1800

Customer No.: 2512

09/868024

JC03 Rec'd PCT/PTC 13 JUN 2001

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Express Mail No.: EL627425795US

In re Application of: STAACK et al.

INTERNATIONAL APPLICATION NO.: PCT/IB99/02076

INTERNATIONAL FILING DATE: 12/13/99

U.S. SERIAL NUMBER:

TITLE: LOCATING SYSTEM FOR MOBILE STATIONS

ATTORNEY DOCKET NO.: 617-010380-US(PAR)

Box PCT

The Commissioner of Patents and Trademarks  
Washington, D.C. 20231

PRELIMINARY AMENDMENT

Dear Sir:

Please amend the above-identified, patent application as follows:

IN THE SPECIFICATION:

After the Title and before the first paragraph, please insert the following new paragraph:

This application claims the benefit of the earlier filed International Application No. PCT/IB99/02076, International Filing Date, 13 December 1999, which designated the United States of America, and which international application was published under PCT Article 21(2) in English as WO Publication No. WO 00/36430.

IN THE CLAIMS

Please amend Claims 3, 5, 6, 7, 12, 13, 19, 22 and 23 which are attached to the Preliminary Examination Report as "Amended Sheets" as rewritten below:

3. A method as claimed in claim 1, wherein the distance of the mobile unit from the base-station is estimated by means of synchronisation information of the cellular radio system.

5. A method as claimed in claim 1, comprising the step of sending a message to the mobile station in dependence on the estimated location.

6. A method as claimed in claim 1, comprising the step of receiving a message from the mobile requesting estimation of its location.

7. A method as claimed in claim 1, comprising the steps of receiving information defining a location; and calculating a route between that location and the estimated location of the mobile station.

12. A unit as claimed in claim 10, wherein the descriptive information comprises road name information.

13. A unit as claimed in claim 10, wherein the location reporting means comprises a wireless application protocol server.

19. Locating apparatus as claimed in claim 16, wherein the said positioning means is a mobile location centre.

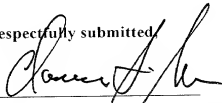
22. A method as claimed in claim 20, wherein the said request is made to a gateway mobile location centre by way of a WTA server.

23. A method as claimed in claim 20, wherein the said report is generated based on information from a gateway mobile location centre and from a location information server.

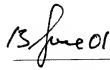
REMARKS

In accordance with 37 C.F.R. §1.121 (as amended on 11/7/2000) the rewritten claim(s) above are shown on separate page(s) marked up to show all the changes relative to the previous version of that section.

Respectfully submitted,



Clarence A. Green Reg. No.: 24,622  
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Customer No.: 2512



Date

**Application entitled: LOCATING SYSTEM FOR MOBILE STATIONS**

**MARKED UP CLAIMS:**

3. A method as claimed in claim 1 or 2, wherein the distance of the mobile unit from the base-station is estimated by means of synchronisation information of the cellular radio system.

5. A method as claimed in ~~any preceding claim 1~~, comprising the step of sending a message to the mobile station in dependence on the estimated location.

6. A method as claimed in ~~any preceding claim 1~~, comprising the step of receiving a message from the mobile requesting estimation of its location.

7. A method as claimed in ~~any preceding claim 1~~, comprising the steps of receiving information defining a location; and calculating a route between that location and the estimated location of the mobile station.

12. A unit as claimed in claim 10 or 11, wherein the descriptive information comprises road name information.

13. A unit as claimed in any of claims 10 to 12, wherein the location reporting means comprises a wireless application protocol server.

19. Locating apparatus as claimed in any of claims 16 to 18, wherein the said positioning means is a mobile location centre.

22. A method as claimed in claim 20 ~~or 21~~, wherein the said request is made to a gateway mobile location centre by way of a WTA server.

23. A method as claimed in any of claims 20 to 22, wherein the said report is generated based on information from a gateway mobile location centre and from a location information server.

LOCATING SYSTEM FOR MOBILE STATIONS

This invention relates to a system for estimating the locations of mobile stations in a cellular radio system. For example, the mobile stations could be mobile telephones in a cellular telephone system.

Figure 1 is a simplified schematic diagram of the radio coverage in an area of a cellular radio network. A number of base-stations 1 to 9 are distributed over the area. Each base-station has one or more base-station transceivers which can transmit and receive radio signals to and from mobile stations. Each base-station transceiver transmits to and receives from a limited area, which represents the cell associated with that base-station transceiver. Figure 1 shows cells 10-19. When a mobile station is in a cell it communicates with the base-station transceiver associated with that cell. As shown in Figure 1, the cells vary in size and shape depending on factors such as the directionality, transmit power and receive sensitivity of the base-station transceiver, and the topography around the base-station. For example, cells 10 and 11 are relatively large and surround their respective base-stations 1 and 2 generally evenly - these represent typical cells in a rural area; cells 12 and 13 are elongate and extend in opposite directions along a main road 22 from a single base-station 3; cells 14-18 are very small - these are typical cells in an urban area.

In a typical cellular radio system the transmissions of each mobile station must be synchronised with the timing of its current base-station. As the mobile moves closer to the base-station its transmissions take less time to reach the base-station; therefore, to maintain synchronisation, it delays its transmissions increasingly (under command from the base-station) as it approaches the base-station. For example, in the GSM cellular telephone system once a connection has been established between a base-station and a mobile station the base-station continually measures the time offset between its own clock and the timing of the signals received from the mobile station. Based on these measurements it calculates a timing advance from 0

to 233  $\mu$ s, coded as a number from 0 to 63 which it transmits regularly to the mobile station. The base-station therefore knows the timing advances (TAs) for all the active mobile stations in its cells.

Since the timing advance is largely determined by the speed of radio propagation (which is known) and the distance of the mobile from the base-station it might be expected that knowledge of the TAs could allow the system to estimate the geographical locations of the mobile stations. For example, where several cells overlap it might be expected that triangulation using the cells' TAs could permit estimation of a mobile's position. However, such schemes have met with many practical difficulties (such as coping with time delays caused by reflected signals) which have made the schemes too complex for widespread implementation.

There is thus a need for a more easily implemented system to allow the geographical location of a mobile station to be determined.

According to one aspect of the present invention there is provided a method for estimating the location of a mobile unit in a cellular radio system, comprising: identifying a cell of the system in which the mobile unit is located; estimating the distance of the mobile unit from the base-station of the cell; determining the location of the base-station; determining bearing information associated with the cell, the bearing information defining a direction; and calculating a location offset from the base-station by the said distance in the said direction to estimate the location of the mobile unit.

In one preferred arrangement the said cell is a cell of a first type and the method comprises the step of, if the mobile station is located in a cell of a second type, estimating the location of the mobile unit to be the location of the base-station of that cell of the second type. The first type of cell may be a cell of generally elongate coverage area. The second type of cell may be a cell of generally non-elongate coverage area.

Preferably the method comprises determining whether the cell in which the mobile unit is located is of the first type or the second type. This may be done on the basis of a stored indication of the type of each cell.

The bearing information is preferably independent of the location of the mobile unit within the cell. The bearing information preferably indicates a direction in which the coverage area of the cell is elongate.

The distance of the mobile unit from the base-station is suitably estimated by means of synchronisation information of the cellular radio system. One example of such synchronisation information is timing advance information. Thus, the synchronisation information suitably represents a timing offset between the mobile station and the base-station.

Once the location has been estimated further action such as processing or sending of messages may be performed to utilise the location information. For example, a message may be sent to the mobile station in dependence on the estimated location. Such a message suitably indicates the estimated location and/or indicates the result of processing based on the estimated location. Such a message may be sent by, for instance, a voice format or a data format such as a text message format. One example of such processing is the calculation of a route between a certain location and the estimated location of the mobile station. That certain location may be received from the mobile itself, for example if the user of the mobile has initiated the calculation of a route to that location.

The estimation of the mobile's location is suitably initiated by a message from the mobile requesting estimation of its location and/or by the elapse of a predetermined time from an event such as the last estimation of the mobile's location.



According to a second aspect of the present invention there is provided a locating unit for estimating the location of a mobile unit in a cellular radio system, the unit being connected to the cellular radio system for reception of information identifying a cell of the system in which the mobile unit is located and information indicative of the distance of the mobile unit from the base-station of the cell, the locating unit comprising: data storage means storing the location of the base-station and bearing information associated with the cell, the bearing information defining a direction; and location calculating means for calculating a location offset from the base-station by the said distance in the said direction as an estimate of the location of the mobile unit.

The data storage means suitably stores cell type information associated with the cell, the cell type information indicating whether the bearing information is to be used in estimating the location of a mobile unit in the cell.

The unit may also comprise logic means for, in dependence on the cell type information, causing the location calculating means either: if the said cell is a cell of a first type, to calculate a location offset from the base-station by the said distance in the said direction as an estimate of the location of the mobile unit; or if the said cell is a cell of a second type, to take the location of the base-station as an estimate of the location of the mobile unit. The unit may also comprise messaging means for generating a message in dependence on the estimated location for transmission to the mobile unit.

According to a third aspect of the present invention there is provided a locating unit for reporting the location of a mobile unit in a cellular radio system, the unit being connected to the cellular radio system for reception of information identifying a cell of the system in which the mobile unit is located and information indicative of the distance of the mobile unit from the base-station of the cell, the locating unit comprising: data storage means storing descriptive information associated with one or more possible distances of a

mobile unit from the base-station of the cell; and location reporting means for generating a report on the location of the mobile unit based on the descriptive information that corresponds to the distance of the mobile unit from the base-station of the cell.

The descriptive information may suitably include place name information and/or road name information and/or distance information. The location reporting means preferably transmits the report to the mobile unit.

The location reporting means may comprise a wireless application protocol (WAP) server or a WTA server of WAP which has a secure connection to a WAP gateway. The location reporting means may comprise means for accepting a request for information on the location of the said mobile unit from a second mobile unit. The said request may be made by means of the wireless application protocol.

According to a fourth aspect of the present invention there is provided locating apparatus for reporting the location of a mobile unit in a mobile telecommunication system including positioning means for determining the geographic location of a mobile unit in response to a request including information identifying that mobile unit, the locating apparatus comprising: location request means for requesting the geographic location of a mobile station from the positioning means; geographic location translation means for receiving the geographic location of the mobile unit from the positioning means and translating the said geographic location into descriptive information; and location response means for generating a response message comprising the said descriptive information.

Suitably the locating apparatus may be capable of providing a content service to respond with the said descriptive information. That may be a wireless application protocol service. The said positioning means may be a mobile location centre.

According to a fifth aspect of the present invention there is provided a method for providing a report on the location of a first mobile station, the method comprising: a second mobile station transmitting a request for information on the location of the first mobile station; estimating the location of the first mobile station; generating a report on the location of the first mobile station; and transmitting that report to the second mobile station; wherein the request and/or the report are transmitted by means of the wireless application protocol. Suitably, the report may be generated by a wireless application protocol server. In addition to the WAP wireless session protocol the request and report may be transmitted using any content transfer protocol, for instance internet hypertext transfer protocol (HTTP).

In each aspect of the invention the mobile unit may, for example, be a radio telephone.

The present invention will now be described by way of example with reference to the accompanying drawings, in which:

figure 1 illustrates cell coverage in a cellular telephone system;

figure 2 shows a schematic diagram of a cellular telephone system;

figure 3 is a flow diagram of the procedure for locating a mobile station;

figure 4 is a schematic diagram of a the environment of a cellular telephone system;

figures 5 and 6 show schematic diagrams of architectures for implementing a locating system in a GSM network; and

figure 7 shows a signalling scheme for requesting information on the position of a mobile station.

The system of figure 2 includes a mobile locating unit (MLU) 30 connected to base-stations 1 to 9 of figure 1 via mobile service centres (MSCs) 31 to 34. The MLU has access to information from the base-stations and data stored in a coverage database 35a and uses them to estimate the geographic location

of mobile stations 36,37 (e.g. cellular telephone handsets) in the system. The basic principle used to locate the mobile stations is as follows. The database 35a stores, for each cell, the geographic location of that cell's base-station and an indication of, when a mobile station is in that cell, whether or not the mobile station's timing advance should be used to estimate the mobile station's location. For the cells for which timing advance is to be used to estimate mobile station location the database also stores bearing data, which indicates the compass bearing from the cell location that mobiles in that cell will be assumed to lie on. Then to estimate the location of a mobile station the MLU determines via the MSCs which cell the mobile is currently in. The MLU consults the information on that cell that is stored in the database 35a. If the database indicates that timing advance (and bearing data) should not be used to estimate the locations of mobiles in that cell then the MLU estimates the mobile station's location to be the location of the base-station associated with that cell. If the database indicates that timing advance (and bearing data) should be used for locating mobiles in that cell then the MLU obtains from the database the bearing data for that cell and obtains from the base-station associated with that cell the mobile station's timing delay. The timing advance is converted to a distance using the known speed of propagation of the radio signals, and the location of the mobile station is estimated as being at a position offset from the base-station by that distance in the direction defined by the bearing information.

The process is illustrated by the flow diagram in figure 3.

The indication of whether the timing delay / bearing data is to be used for any base-station could be stored separately from the bearing data itself, or a special value of the bearing data for a base-station (e.g. 400°) could be used to indicated that the timing delay / bearing data is not to be used for that base-station.

The process of estimating the mobile's location could be initiated by the sending of a message from the mobile to the MLU over the radio system.

The cells for which the database defines that the TA should be used in locating are elongate cells (such as cells 12 and 13 in figure 1), for which the corresponding bearing data defines the compass bearing along which the elongation of the cell extends from the associated base-station. The other cells are those for which the TA is not used in locating.

Therefore, referring to figure 1, if the mobile is in one of the cells 14 to 18 its location will be estimated to be the location of the respective base-station 5,8,9,7,6. Since these cells are small in area and centred on their respective base-station the estimate of location will be relatively accurate. If the mobile is in one of the cells 12,13 its location will be estimated using the TA to lie at a point along the major axis of the cell. Since these cells are narrow perpendicular to that axis the estimate of location will again be relatively accurate, subject to errors due to disproportionality of the TA with distance from the base-station caused by factors such as reflection of signals. If the mobile is in one of the cells 10,11,19 then its location will be approximated to be the location of the respective base-station 1,2,4. This is relatively inaccurate but since these are rural cells, in many networks a typical mobile will only rarely occupy such a cell. The present system therefore provides a greatly simplified method of locating mobiles, with relatively little loss in performance over much more complex systems.

The process of calculating an estimate of a mobile's location from its timing advance will now be described. Using a normal orthogonal geographical grid system the location of a base-station (e.g. base-station 3 in figure 1) can be indicated as co-ordinates  $x_b$ ,  $y_b$ , where  $x_b$  is a northing and  $y_b$  is an easting. The bearing data for the relevant cell can be indicated as  $\theta$  degrees from north and the mobiles' timing delay can be indicated as  $t$  seconds. Taking the speed of radio signals to be  $v = 3 \times 10^8$  ms<sup>-1</sup> the mobile's distance  $d$  from the base-station is estimated by:

$$d = v t$$

and the co-ordinates of the mobile's estimated location are  $x_m$ ,  $y_m$ , where:

$$x_m = x_b + d \cos \theta$$

$$y_m = y_b + d \sin \theta$$

Once the location of the mobile station has been determined the MLU can transmit that information to the mobile station or another unit. Some convenient ways for this to be done are by text or voice messages over the radio system. For instance, in a GSM system text messages could be sent by SMS (short message service) or USSD (unstructured supplementary services data).

The MLU (or another unit having received the location information) could perform further processing based on the location information together, optionally, with other information such as information derived from a geographical database 35b. The geographical database could, for example, store the locations of geographical features such as towns and roads: one example of such a database is the Finnish Genimap system. Examples of the further processing that is possible are as follows:

1. The MLU could determine the location of the mobile relative to geographical features in the database and generate a message to report the location relative to those features, such as "you are in town X" or "you are between towns X and Y" or "you are 5km from town X on road Z".

2. If the MLU is capable of receiving messages from a user of the mobile (e.g. by the SMS system) the user could, by means of a message, request the MLU to use its database to perform a calculation and report the result by a message. For example, the user could request the MLU to suggest a route from the mobile's location to a specified location, or to calculate the distance from the mobile's location to a specified location. The MLU could also suggest a route from the mobile's current location to a present location such as the mobile user's home. The mobile user's home location could be determined by the MLU from information available from the radio network's billing centre or subscriber database. Using estimates of driving speeds and travel costs the MLU could report estimated journey times and costs for suggested routes.
3. The MLU could (e.g. following a request by the user) send messages periodically (e.g. every 15 minutes) to report the mobile's location.

Figure 4 illustrates a specific example of location estimations. Figure 4 shows the A616 road extending between the towns of Olvila and Kosula and covered by an elongate radio cell from a base-station 38. The base-station measures and calculates the timing advance for the mobile station and gets the value 21. This value 21 corresponds to a distance of 8km from the base-station 37 at Turpela. So the location of the mobile station is 12km (4km + 8km) from Olvila, and 13km (21km - 8km) from Kosula. By monitoring the mobile's location over time the direction of movement of the mobile along the road/cell can be determined.

If the user asks to know the distance to some far away place, for example Hauho, we need to compare the distance from Hauho to Olvila and from Hauho to Kosula. The shorter way (= Kosula - Hauho plus 12km) will be informed to the user and it will also be used for route assistance. The mobile station user could get a message "you are in Aavasaksa (A616), 12km from Olvila and 13km from Kosula, you have 583km to go to Hauho, Do you want route assistance?" To simplify the integration of the coverage database 35a with the geographic database 35b the locations of base-stations could be approximated to geographic locations already held in the geographic database. Alternatively, the two databases could use a common geographical grid system or the MLU could translate between different grid systems

used by the databases. In some cases supplementary locations could be added to the geographic database, also to assist in calculating routes and distances.

Another alternative avoids the need for the storage of bearing information. One of the databases could store a list of descriptive information to each or to a range of timing advances. Once the location of a mobile station had been determined a description of the mobile station's location based on that descriptive information could be reported to a user. In the example of figure 4, the table could hold the following information:

| Timing Advance | Place     | City 1 | City 2 | Road |
|----------------|-----------|--------|--------|------|
| 0 to 7         | Turpela   | Olvila | Kosula | A616 |
| 8 to 16        | Jankhala  | Olvila | Kosula | A616 |
| 17 to 22       | Aavasaksa | Olvila | Kosula | A616 |
| 23 to 35       | Perala    | Olvila | Kosula | A616 |
| over 35        | Kosula    | Kosula | Kosula | A616 |

City 1 and city 2 are major places between which the mobile station's location lies.

Examples of descriptions based on this information that could be reported to a user at timing advance 10 are:

"You are in Jankhala on the A616"

or (by calculation of the distance corresponding to a certain timing advance and knowledge of the distance of the base station from city 1 and city 2):

"You are in Jankhala (A616) 9 kilometres from Olvila and 16 kilometres from Kosula".

For non-linear cells, or in general cells for which the distance of the mobile unit from the base station is not to be taken into account in generating a report of the mobile station's location, the corresponding table could hold merely a single set of location data describing, for example, the central point of the cell.

Figures 5 and 6 show some schematic architectures for implementing this system in a GSM cellular telephone network. Like reference numbers refer to like units in these



figures and figure 2. In figure 5 the MLU 30 is connected to the network via a messaging unit 39 that allows bi-directional SMS or USSD message traffic between the MLU 30 and mobile 36. In figure 6 there is also a messaging platform 41 that acts as a gateway between the messaging unit 39 and a network 40, such as the internet, via which the MLU 30 is connected to the cellular network.

It will be appreciated that the present invention is especially advantageous in connection with in-vehicle mobile cellular radio mobile units. The mobile unit could be a mobile telephone or another mobile communication unit. The cellular network could be a cellular telephone network.

The invention may also be implemented with the proposed GPRS (general packet radio service). The proposed GPRS standards define support for a short message service centre and the GPRS radio interface also makes use of calculated/measured timing advances. The high data rates (40-100kb/s) available through GPRS could allow for more convenient use of data-intensive functionality. For example, having estimated the location of a mobile station the MLU could transmit information to the mobile station to allow it to display a map of its surroundings. Of course, such a feature could be implemented, albeit less conveniently, in systems having lower data rates. In the GPRS system messages to or from the mobile unit and/or the MLU could be sent via the SGSN (serving GPRS support node) or the MSC (mobile switching centre).

Signal strength information may be used either instead of or in combination with the timing advance information to estimate the distance of the mobile from the base-station.

When a person makes a telephone call to a mobile telephone one of the first things that he often asks the user of the mobile station is the location of that user. It would be useful for there to be a procedure whereby this information could be exchanged automatically. Figure 7 illustrates a signalling scheme whereby one mobile station may request and receive information on the location of another mobile station. In connection with this signalling method the location of the latter mobile station may be determined in accordance with the procedures described above or in another way,

and could be in accordance with GSM 03.71. The unit requesting the location information may be a mobile station or another unit capable of the necessary signalling.

The signalling scheme illustrated in figure 7 involves a request by a mobile station MS1 (illustrated at 50) for information on the location of another mobile station MS2. MS1 is operable according to the WAP (wireless access protocol) and has a WAP user agent 51 and a WAP repository 52. Also illustrated in figure 7 are a WAP gateway 53, a WTA server 54 and a mobile network 55 in which the mobile station MS2 is operable. The WTA server has access to a location information server 56, and the mobile network includes an MLC (mobile location centre) 57 which could be in accordance with GSM 03.71. The mobile location centre 57 provides a service for determining the location of MS2, and preferably also stores the last known location of MS2. The location information server 56 includes a geographical database of verbal descriptions of locations, whereby a descriptive phrase may be generated in response to location information as provided from the location information server. The verbal descriptions may be supplemented or replaced by graphical pictures comprising a map. In that case the geographical database may include a map database performing mapping from location information to map extracts.

The operation of the signalling scheme of figure 7 is as follows. The WAP user agent 51 makes a request for the URL (uniform resource locator) of the location description service. The URL specifies a WAP deck to interface to the location information service. The user of MS1 inputs the identity of MS2, which can for example be the MSISDN of MS2. The WAP deck issues a request for a URL for the same location description service; this time the URL including the identity of MS2. MS1 sends the request to the WAP gateway 53, which forwards that request to the WTA server 54. The WTA server extracts the identity of MS2 from the URL.

Thereafter, the WTA server contacts a GMLC (gateway mobile location centre). The GMLC contacts the HLR of MS2 (not shown in figure 7) in order to determine which network and visitor MSC/VLR MS2 is currently operating in. The GMLC then requests the position of MS2 from the visitor MSC/VLR. The visitor MSC/VLR determines the location of MS2 and returns the result to the GMLC. The GMLC

returns the result to the WTA server. The result may, for instance be given in co-ordinate form or as the identity of the cell in which MS2 lies. The WTA then consults location information server 56 in order to establish a description of that location – for example a place name or a street name. The WTA server returns that description to the WAP gateway, which transfers it back to MS1 to answer the position request from MS1. MS1 then displays the information to its user. The response could be transferred to MS1 as a response to the URL request containing the identity of MS2 or by WAP push, as an unstructured message or by another means. The WAP deck for the location description service may be available in the WAP repository when its URL is first requested, therefore its downloading from the WTA server may not be necessary.

The WTA server and the location information server may be seen as logical services. This means that they may be distributed to physical nodes in a number of different ways. For example, the WTA server and the location information server can be within the GMLC node.

For reasons of confidentiality it is preferred that a list of entities that are permitted to be given location information on a mobile station such as MS2 is stored. Such a list may be stored at the respective HLR. Thus, when the WTA contacts the HLR of MS2 the HLR may check that MS1 is permitted to receive location information about MS2 and otherwise causes the request from MS1 to be rejected. A WAP interface could be provided to allow a user to alter his list. The list may be part of location profile information. For this and other security reasons it is preferred that the WAP application is located at the WAP server.

The WTA server could store a list correlating user names and phone numbers or other identities (e.g. MSISDN). Alternatively the WTA server could be capable of consulting such a list stored elsewhere, for example at a global name server or HLR.

The GMLC could store the last known locations of mobile stations so that it can return the last known location of a mobile station if the mobile station is out of coverage (e.g. in a building) or switched off. The MLC could alternatively obtain that information from the appropriate VLR.

The present invention may include any feature or combination of features disclosed herein either implicitly or explicitly or any generalisation thereof, irrespective of whether it relates to the presently claimed invention. In view of the foregoing description it will be evident to a person skilled in the art that various modifications may be made within the scope of the invention.

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**CLAIMS**

1. A method for estimating the location of a mobile unit in a cellular radio system, said system comprising elongate cells and non-elongate cells, and said method comprising:

identifying a cell of the system in which the mobile unit is located;

determining whether the cell is elongate or non-elongate;

determining the location of the base-station;

if the cell is non-elongate, estimating the location of the mobile unit to be the location of the base station of the cell; or

if the cell is elongate, estimating the distance of the mobile unit from the base-station of the cell, determining bearing information associated with the cell, the bearing information defining a direction, and estimating the location of the mobile unit by calculating a location offset from the base-station by the said distance in the said direction.

2. A method as claimed in claim 1, wherein the bearing information is independent of the location of the mobile unit within the cell.

3. A method as claimed in claim 1 or 2, wherein the distance of the mobile unit from the base-station is estimated by means of synchronisation information of the cellular radio system.

4. A method as claimed in claim 3, wherein the synchronisation information represents a timing offset between the mobile station and the base-station.

5. A method as claimed in any preceding claim, comprising the step of sending a message to the mobile station in dependence on the estimated location.

6. A method as claimed in any preceding claim, comprising the step of receiving a message from the mobile requesting estimation of its location.

7. A method as claimed in any preceding claim, comprising the steps of receiving information defining a location; and calculating a route between that location and the estimated location of the mobile station.

8. A locating unit for estimating the location of a mobile unit in a cellular radio system, the unit being connected to the cellular radio system for reception of information identifying a cell of the system in which the mobile unit is located and information indicative of the distance of the mobile unit from the base-station of the cell, said system comprising elongate and non-elongate cells, said locating unit comprising:

data storage means storing the location of the base-station and, if the cell is elongate, bearing information associated with the cell, the bearing information defining a direction; and

location calculation means for, if the said cell is non-elongate, calculating the location of the base-station as an estimate of the location the mobile unit, and if the said cell is elongate, calculating the distance of the mobile unit from the base-station of the cell and calculating a location offset from the base-station by the said distance in the said direction as an estimate of the location of the mobile unit.

9. A unit as claimed in claim 8, comprising messaging means for generating a message in dependence on the estimated location for transmission to the mobile unit.

10. A locating unit for reporting the location of a mobile unit in a cellular radio system, the unit being connected to the cellular radio system for reception of information identifying a cell of the system in which the mobile unit is located and information indicative of the distance of the mobile unit from the base-station of the cell, the locating unit comprising:

data storage means storing descriptive information associated with one or more possible distances of a mobile unit from the base-station of the cell; and

location reporting means for generating a report on the location of the mobile unit based on the descriptive information that corresponds to the distance of the mobile unit from the base-station of the cell.

11. A unit as claimed in claim 10, wherein the descriptive information comprises place name information.

12. A unit as claimed in claim 10 or 11, wherein the descriptive information comprises road name information.

13. A unit as claimed in any of claims 10 to 12, wherein the location reporting means comprises a wireless application protocol server.

14. A unit as claimed in claim 13, wherein the location reporting means comprises means for accepting a request for information on the location of the said mobile unit from a second mobile unit from a second mobile unit.

15. A unit as claimed in claim 14, wherein the said request is made by means of the wireless application protocol.

16. Locating apparatus for reporting the location of a mobile unit in a mobile telecommunication system including positioning means for determining the geographic location of a mobile unit in response to a request including information identifying that mobile unit, the locating apparatus comprising:

location request means for requesting the geographic location of a mobile station from the positioning means;

geographic location translation means for receiving the geographic location of the mobile unit from the positioning means and translating the said geographic location into descriptive information; and

location response means for generating a response message comprising the said descriptive information.

17. Locating apparatus as claimed in claim 16, wherein the locating apparatus is capable of providing a content service to respond with the said descriptive information.

18. Locating apparatus as claimed in claim 17, wherein the said service is a wireless application protocol service.

19. Locating apparatus as claimed in any of claims 16 to 18, wherein the said positioning means is a mobile location centre.

20. A method for providing a report on the location of a first mobile station, the method comprising:

a second mobile station transmitting a request for information on the location of the first mobile station;

estimating the location of the first mobile station;

generating a report on the location of the first mobile station; and

transmitting that report to the second mobile station;

wherein the request and/or the report are transmitted by means of the wireless application protocol.

21. A method as claimed in claim 20, wherein the report is generated by a wireless application protocol server.

22. A method as claimed in claim 20 or 21, wherein the said request is made to a gateway mobile location centre by way of a WTA server.

23. A method as claimed in any of claims 20 to 22, wherein the said report is generated based on information from a gateway mobile location centre and from a location information server.



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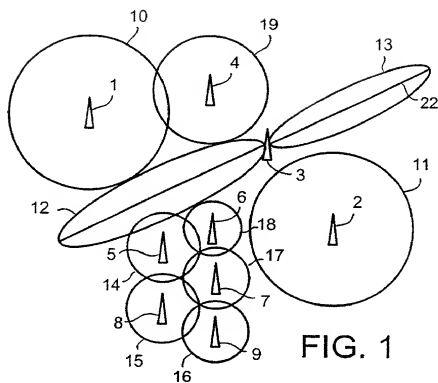


FIG. 1

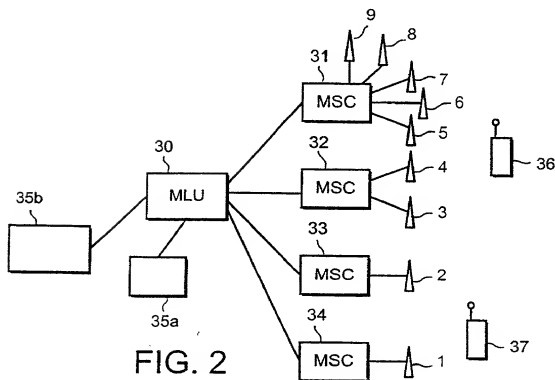


FIG. 2

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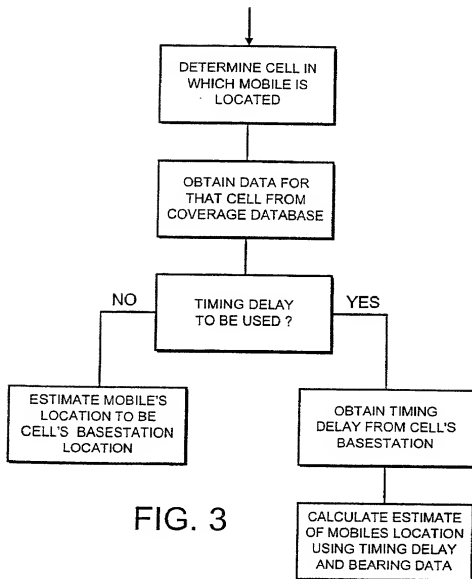
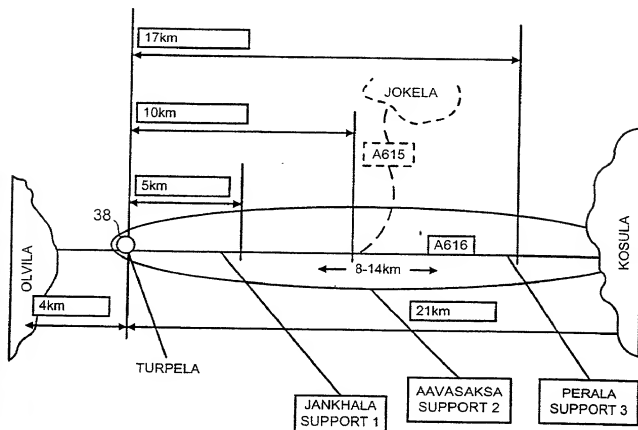


FIG. 3

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FIG. 4



|              |                                |
|--------------|--------------------------------|
| BASE STATION | TURPELA<br>TA=0-8, 0-3kms      |
| NEIGHBOUR 1  | OLVILA<br>4km                  |
| NEIGHBOUR 2  | KOSULA<br>21km                 |
| SUPPORT 1    | JANKHALA<br>TA=8-20, 3-8kms    |
| SUPPORT 2    | AAVASAKSA<br>TA=21-32, 8-14kms |
| SUPPORT 3    | PERALA<br>TA=33-45, 14-19kms   |
| ROAD         | A616                           |

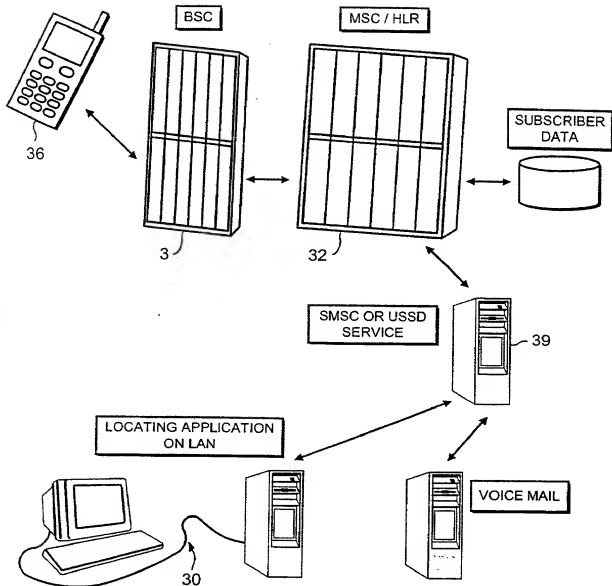


FIG. 5

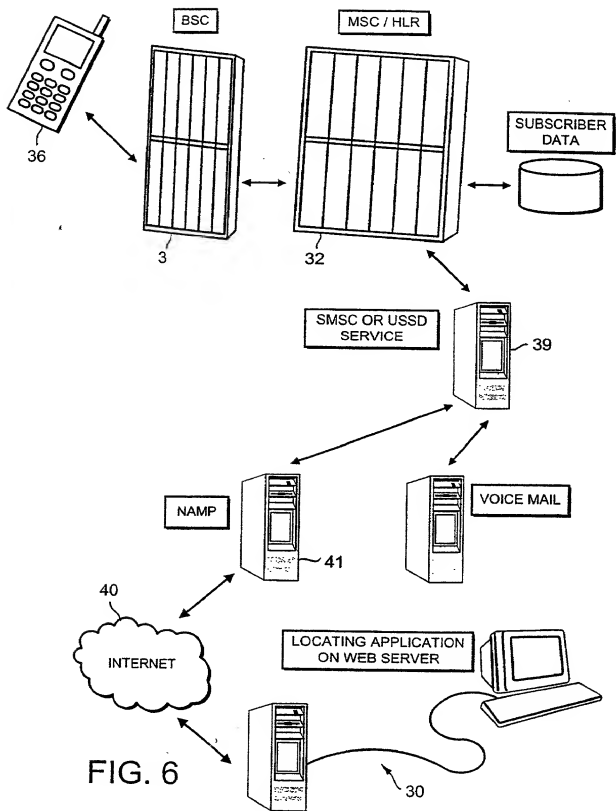
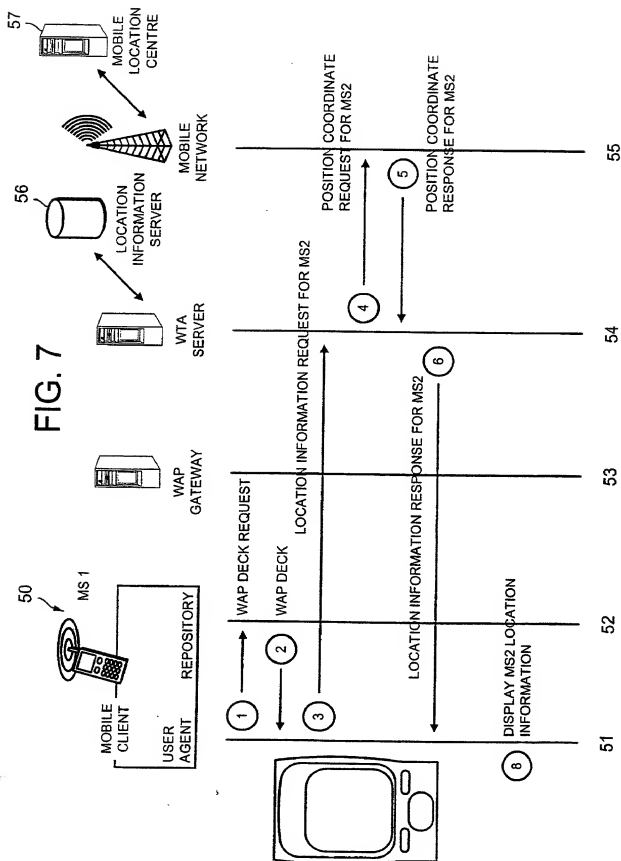


FIG. 6



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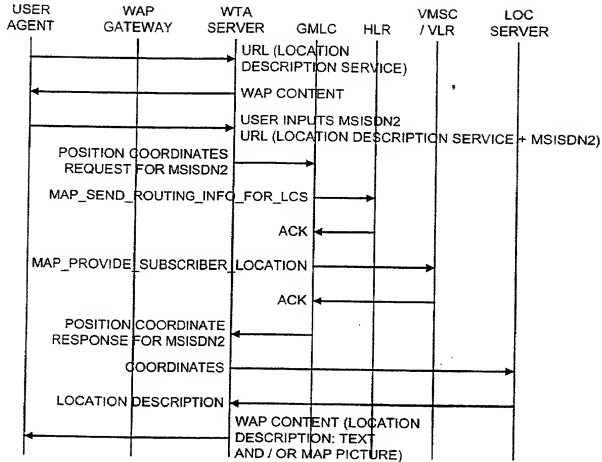


FIG. 7 CONT'D

# DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

## English Language Declaration

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

Title: LOCATING SYSTEM FOR MOBILE STATIONS

the specification of which

(check one)

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is attached hereto.

X as filed on as United States Application No.09/868,024 or PCT  
International Application Number PCT/IB99/02076 filed 13 December 1999  
and was amended on (if applicable)

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d) or Section 365(b) of any foreign application(s) for patent or inventor's certificate, or Section 365(a) of any PCT International Application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate or PCT International application having a filing date before that of the application on which priority is claimed.

### Prior Foreign Application(s)

| (Number)       | (Country)      | (Day/Month/Year Filed) | <u>Priority Not Claimed</u> |
|----------------|----------------|------------------------|-----------------------------|
| GB 9827505.0   | United Kingdom | 14 December 1998       | <input type="checkbox"/>    |
| GB 9927207.2   | United Kingdom | 17 November 1999       | <input type="checkbox"/>    |
| PCT/IB99/02076 | PCT            | 13 December 1999       | <input type="checkbox"/>    |



I hereby claim the benefit under 35 U.S.C. Section 119(e) of any United States provisional application(s) listed below:

\_\_\_\_\_  
(Application Serial No.)

\_\_\_\_\_  
(Filing Date)

\_\_\_\_\_  
(Application Serial No.)

\_\_\_\_\_  
(Filing Date)

\_\_\_\_\_  
(Application Serial No.:

\_\_\_\_\_  
(Filing Date)

I hereby claim the benefit under 35 U.S.C. Section 120 of any United States application(s), or Section 365(c) of any PCT International Application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International Application in the manner provided by the first paragraph of 35 U.S.C. Section 112, I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, C.F.R., Section 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application:

\_\_\_\_\_  
(Application Serial No.)

\_\_\_\_\_  
(Filing Date)

\_\_\_\_\_  
(Status)  
(patented, pending, abandoned)

\_\_\_\_\_  
(Application Serial No.)

\_\_\_\_\_  
(Filing Date)

\_\_\_\_\_  
(Status)  
(patented, pending, abandoned)

\_\_\_\_\_  
(Application Serial No.)

\_\_\_\_\_  
(Filing Date)

\_\_\_\_\_  
(Status)  
(patented, pending, abandoned)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (list name and registration number)

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